Example Exam
Data Communication and Networks DT113G

Instructors:

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The **instructors are available** for clarifications from **09:15 to 10:15** on **Zoom:**

> Zoom link: **https://oru-se.zoom.us/my/oscarmm**
> Zoom phone: +46 850 539 728 (meeting ID: 420 748 5391)

Exam details:

Total number of exercises: 8
Total number of points: 100
Exam time: 08:15 - 12:15 (4 hours)

Wiseflow **closes at 12:15:00**, that means it will not be possible to submit from 12:15:00.

Grading:

U corresponds to **less than 55** points
3 corresponds to **55** to 69 points
4 corresponds to **70** to 84 points
5 corresponds to **85** or more points

NO extra points are added because this is a **resit exam**.

Indications to answer:

- Each question indicates the points awarded when the **answer is fully correct**. **Write explanations** of how you thought. Even a wrong answer can give you points if you show that your thoughts were right. Please, use **short and complete sentences**.

- If a question or exercise looks unclear to you, then **make reasonable assumptions** and write them down.

- The only allowed materials are the course **book**, and the **material on Blackboard**.

- Write your solution using the word-processor of your choice, **save it in PDF format** and upload the PDF. You can also write your solution on paper (with clear handwriting), **scan it in PDF** format and upload the PDF. In this last case, if the writing is not legible we may skip the assessment of the unreadable responses.

- Answer **in English.** We do not evaluate your level of English.

Indications about plagiarism in home exams:

- This is an individual take-home exam, which means that no cooperation is permitted.

- You must answer using your own words, demonstrating your own knowledge and understanding. In cases where you refer to sources or use quotes, you must clearly include the sources in your answers.

- Your answers will be checked using the plagiarism detection tool Urkund.

- This exam is conducted remotely, giving you the choice of where you take your exam before you submit your answers. This does not, however, give you permission **to use any aids other than those permitted according to these instructions**. Consequently, you are not allowed to use any other aids for support or to help you answer the questions. Nor is any kind of cooperation allowed during the exam, which means that you are not allowed any contact with any other person or student during the exam for support or for help in answering the questions. Documents referring to the examination may not be shared between students via social media or similar. If information of any such actions come to the university's attention, a report on suspected cheating will be submitted to the Disciplinary Committee.

- If you choose to copy, in an unauthorised manner, text from another student or another source on the Internet (other than the allowed), passing the text or a rephrasing thereof as your own answers, you run the risk of being reported to the Disciplinary Committee and found guilty of cheating. The decisions of the Disciplinary Committee are public official documents and can be accessed by anyone. The plagiarism detection tool Urkund always look for text similarities.

- The Disciplinary Committee can impose suspension of up to 6 months for such actions.

Question 1 - 10 pts

Assume you are inside the Örebro University network. You open a browser and type:

http://blabla.com/index.html

in the address bar.

Explain briefly (no more than half a page) what happens until the webpage is displayed. Indicate the protocol(s) used, a high level description of the messages exchanged, and the potential use of external servers that are contacted when needed (e.g. DNS servers, cache servers, etc.).

Question 2 - 5 pts

Explain the different parts of the following HTTP message received by a client host:

HTTP/1.1 200 OK<cr><lf>Server: Apache/3.09<cr><lf>Date: Thu, 20 Sept 2020 13:00:15 GMT<cr><lf>Connection: close<cr><lf>Content-Length: 31<cr><lf>Content-Type: text/html<cr><lf><cr><lf><!doctype html><body>bye</body><lf>

Question 3 - 20 pts

Suppose host A and host B use the GBN protocol with window size N=3. Host A sends six packets to host B: p0, p1, p2, p3, p4, p5. However, the acknowledgment for packet p1 is lost. In addition, packet p3 is lost the first time it is sent.

Draw a timing diagram showing the packets and the acknowledgments. **Briefly explain your answer.**

Question 4 - 20 pts

The figure depicts a LAN network which is connected to the internet through a router using the NAT protocol.
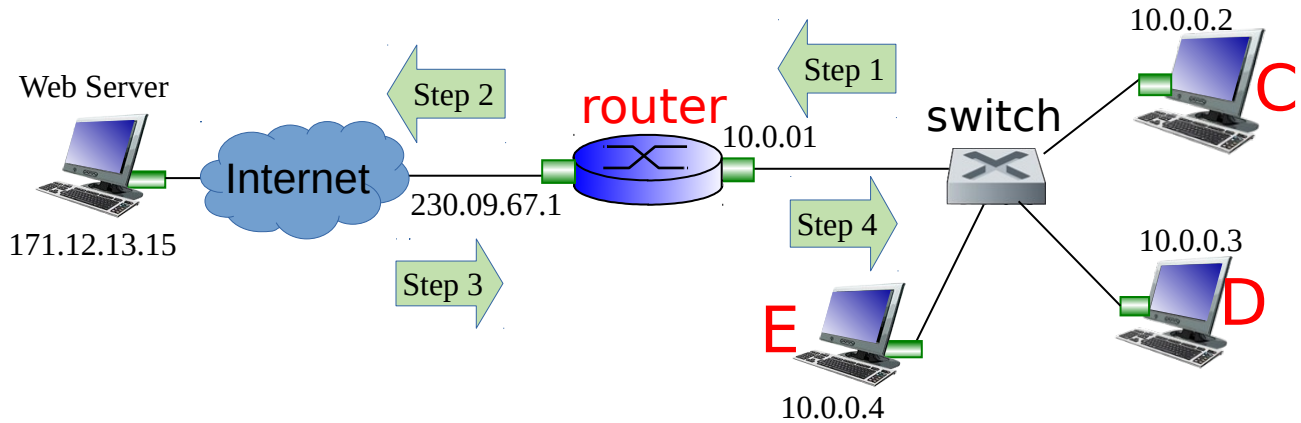
(a) Complete the NAT translation table for the 3 hosts (C,D,E) in the LAN. You are free to choose the port numbers in the hosts and in the router. **Briefly explain your answer.**

NAT translation table	
WAN side	LAN side

(b) Host **D** in the LAN wants to access a web server (IP: 171.12.13.15, port:80) on the internet. Indicate the source and destination IP addresses and ports of the datagrams at steps (1), (2) , (3) and (4). **Briefly explain your answer.**

At step (1) the datagram is transmitted from host **D** to the router:
Source IP address:
Source port:
Destination IP address:
Destination port:

At step (2) the datagram is transmitted from the router to the web server:
Source IP address:
Source port:
Destination IP address:
Destination port:

At step (3) the datagram is transmitted from the web server to the router:

Source IP address:

Source port:

Destination IP address:

Destination port:

At step (4) the datagram is transmitted from the router to host **D**:
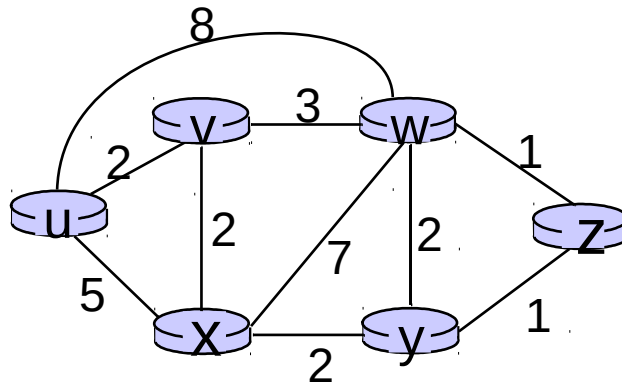
Source IP address:

Source port:

Destination IP address:

Destination port:

Question 5 - 20 pts

Calculate the **forwarding table** for node **u** using the Dijkstra algorithm. Indicate the steps in the following trace table. **Add a brief explain about how the Dijkstra algorithm works.**

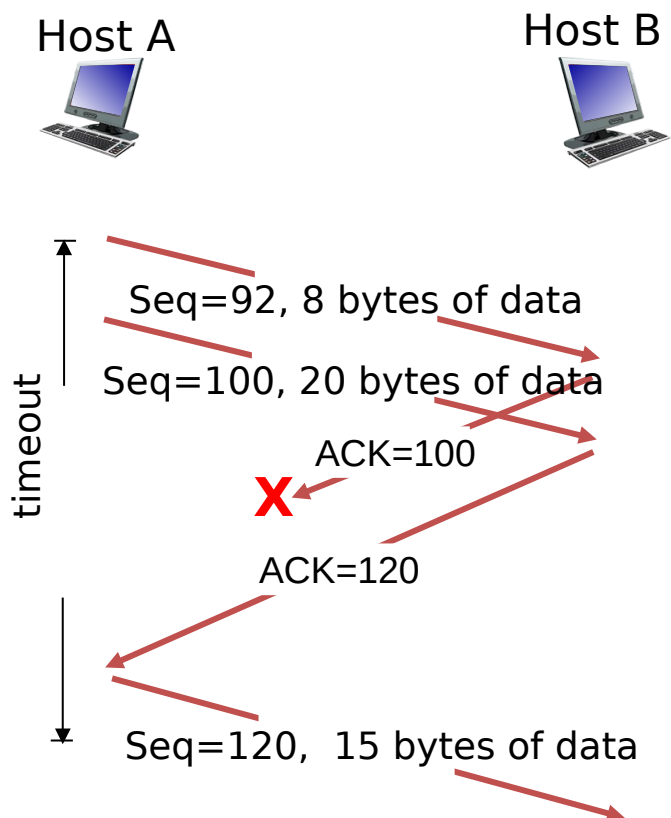| Step	N'	D(v), p(v)	D(w), p(w)	D(x), p(x)	D(y), p(y)	D(z), p(z)
0	u					

Question 6 - 5 pts

Explain the difference between the "polling" and the "token passing" MAC protocols.

Question 7 - 10 pts

In the TCP protocol situation showed in the figure, explain the reason why Host B does not need to re-send back ACK=100, even if this message was lost.

Host A   Host B

timeout

Seq=92, 8 bytes of data

Seq=100, 20 bytes of data

ACK=100

X

ACK=120

Seq=120, 15 bytes of data

Question 8 - **10 pts**

One computer acting as client sends the following 32 bits to a server using UDP:
1000101010100111 1000010100111101

The server receives the the following string:
1000101010101111 1001010100111101

Show the steps taken by the client and the server to create a 16 bits checksum code and to check the integrity of the data (whether there is an error or not). **Briefly explain your answer.**